

Synthetic Turf/Recycled Tire Crumb Rubber Research Program

Background Materials

California Office of Environmental Health Hazard Assessment (OEHHA Synthetic Turf Study)
<http://www.oehha.ca.gov/risk/SyntheticTurfStudies/index.html>

Federal Research on Recycled Tire Crumbs Used on Playing Fields
<https://www.epa.gov/chemical-research/federal-research-recycled-tire-crumbs-used-playing-fields>

OEHHA request to NTP
<http://www.oehha.ca.gov/risk/SyntheticTurfStudies/TurfRequest040416.html>

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Background and Rationale

Over 11,000 synthetic turf fields exist in the U.S., with approximately 1,200 being added annually. In addition to being installed in professional sports stadiums, synthetic turf is increasingly found at public parks and school athletic fields. The component of turf that is of most concern is crumb rubber infill, made from recycled automotive tires. Crumb rubber contains numerous potential carcinogenic and toxic substances, yet the exposure of people playing on installed fields to these hazardous components is not well understood.

Public concern for potential health risks of playing on synthetic turf field increased after reports in the media of young adult soccer players, particularly goalies, being diagnosed with blood cancers. In 2015 the California Office of Environmental Health Hazard Assessment (OEHHA) began an Environmental Health Study of Synthetic Turf and in early 2016 the U.S. Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (ATSDR), and the U.S. Consumer Product Safety Commission (CPSC) launched the Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields. Both of these efforts include better exposure characterization through collection of tire crumb rubber from recycling facilities and installed fields, extensive physical and chemical analysis of the material, estimation of the nature and duration of exposures to players, and review of the available literature on human health effects of synthetic turf and its chemical components.

In November 2015, OEHHA requested that the National Toxicology Program conduct short-term *in vivo* and *in vitro* toxicology studies to enhance understanding of the health impacts of chemicals released from synthetic turf, with an emphasis on the crumb rubber in the fields. Information gained from such studies would help OEHHA evaluate health impacts associated with the use of crumb rubber in synthetic turf fields and playground mats.

Challenges

- Exposures to synthetic turf components or emissions likely involve a complex mixture of particulate and vapor phase chemicals including volatile organic compounds and metals. The exposure route can be respiratory, oral ingestion, and/or dermal. Toxicology studies employing exposure scenarios similar to human exposures would be the most useful.

- While OEHHA requested evaluation of endpoints with relevance to hematopoietic cancers, any effect would provide valuable information on toxicity including a broad set of endpoints - not exclusively cancer outcomes.
- OEEHA requested that because of ongoing exposures, data would be most useful if it could be available within an 18-month timeframe.

Approach

- Explore feasibility of conducting *in vivo* exposures to crumb rubber itself or component chemicals in a manner that will generate useful information for characterizing hazard.
- Conduct short-term (28-day) toxicity studies in rodents considering major organ pathology, genotoxicity, gene expression analysis, and clinical chemistry including early markers for hematopoietic cancers.
- Determine appropriate conditions for exposing human and rodent cells to crumb rubber components including solvent-based and biologically-relevant extraction methods, co-culture, and air-liquid interface models.
- Conduct *in vitro* testing of a variety of cultured cells (e.g., human cell lines, primary or stem cells) assessments of cytotoxicity, genotoxicity, and gene expression analysis.
- Include comparative toxicity assessments of chemicals with known toxicities in these *in vitro* tests in addition to specific marker chemicals that are identified as components of the tire crumb rubber (e.g. benzothiazoles).

Significance

People are coming into contact with recycled tire crumb rubber used in synthetic turf and have concerns for their health and the health of their children. A deeper understanding of both human exposure and hazard is necessary, and the NTP study of synthetic turf/crumb rubber will provide public health agencies with toxicity information to inform exposure and health assessments. In conjunction with the extensive chemical and human exposure conducted as part of the OEHHA study and the Federal Research Action Plan, this work will substantially contribute to what is known about potential human health effects of playing on synthetic turf fields made from recycled tires. Continued communication and collaboration with both of these efforts will allow NTP to respond to their findings with additional toxicological testing to focus on specific components, exposure scenarios, and outcomes of most concern identified by these research efforts.